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We want you! Recruitment strategies for the success of a citizen science project on urban wildlife ecology

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In this case study, we report on the recruitment of participants for a citizen science (CS) project on urban wildlife monitoring (about 860 participants), and the consequences of recruitment strategies for achieving the project goals. We describe the approach that we used to identify our target audience and to design the core message for the recruitment campaign. We searched for participants who were interested in wildlife and in the scientific research process. We based the recruitment campaign on the appeal of discovering wildlife in people's immediate surroundings. Recruitment was successful in terms of the number of applications we received. Participants' interests reflected their focus on wildlife, and we discuss how this was reflected in their engagement. We use this case study to highlight the importance of deliberately designing recruitment strategies for CS projects. Such strategies will have implications for participants' motivation and ultimately may influence their contributions to the project.

KEYWORDS

citizen science, recruitment, interest, wildlife, participation

1 Introduction

Effective science communication has become increasingly important to counter phenomena ranging from fake news and misinformation over conspiracy theories and beliefs to vaccination skepticism. To increase trust in science and emphasize its important role for society, citizens may need to learn more about science and get involved with its processes (Bromme and Goldman, 2014). One way for citizens to do so is to engage in citizen science (CS) projects. These are projects in which volunteering citizens participate in scientific research projects and collaborate with scientists (Bonney et al., 2009; Heigl et al., 2019). Yet, finding citizens who volunteer to engage with scientific research projects can be challenging and different recruitment strategies have been suggested (Andow et al., 2016; West and Pateman, 2016; Crall et al., 2017; Fischer et al., 2021). In this case study, we report on the suitability of a recruitment campaign of a CS project on monitoring urban wildlife.

Through digital technologies, increasingly diverse CS projects are available for citizens to participate in (Preece, 2016) on a growing number of online platforms (e.g., www.zooniverse.org, Cox et al., 2015; www.ispotnature.org; Silvertown et al., 2015; www.inaturalist.org; Aristeidou et al., 2021). These platforms feature projects from a diverse

spectrum of disciplines, from environmental science through astrophysics and chemistry to literature and the arts. On the one hand, CS is an immense support for scientists in gathering extensive data sets and carrying out large scale research (Cooper et al., 2007; Cohn, 2008). It is also a valuable means to increase the societal relevance of scientific research (Hecker et al., 2018). On the other hand, participating in a CS project can be beneficial for the volunteering citizens, as they may gain knowledge about new topics and the scientific research process. Moreover, they can benefit from other individual outcomes, such as learning new skills, exploring scientific data, sharing experiences with other citizens and scientists, and gaining a sense of scientific self-efficacy (Phillips et al., 2018; 2019). In this sense, CS offers great potential for science communication, because in CS projects research and communication are not separate processes, but closely intertwined (Wagenknecht et al., 2021). Through interactions between scientists and citizens, the target audience essentially becomes involved in the communication process itself (Giardullo et al., 2023), thus moving communication beyond mere dissemination of project results (Gascoigne et al., 2022).

In this manner, CS can be a tool for science communication. Conversely, science communication is a key component for successfully recruiting, retaining, and motivating citizen scientists (Baruch et al., 2016; Wagenknecht et al., 2021). Since communication strategies shape the expectations associated with CS in general and specific projects in particular, they need to be well thought out and appropriate for the level of participation (Gascoigne et al., 2022). For those CS projects created by academic scientists, the success of the scientific research endeavor depends on citizens' involvement - that is, a sufficient number of citizens must be willing to participate and engage in the project tasks. Therefore, the successful recruitment of volunteers is essential for the overall success of CS projects (West and Pateman, 2016; Fischer et al., 2021), and communication is the key tool needed to achieve this (Hecker et al., 2018; Golumbic et al., 2020). In order to develop a recruitment campaign, it is necessary to understand who would potentially be willing to participate in a CS project and why this is the case (e.g., Füchslin et al., 2019). Then, it is essential for the success of the project to tailor communication to reach the various interest groups (Wagenknecht et al., 2021). For this purpose, it is important to define the target audience and to understand their interests, demographics, and motivations. In their marketing messages, scientists need to create clear and compelling content that highlights the benefits and impact of a CS project and emphasizes how participants can contribute to scientific research, make a difference, or acquire new skills.

Recruitment does not merely aim at attracting a large number of people—it aims at generating interest among specific target groups with the appropriate type of messages and campaigns (Brouwer and Hessels, 2019). Although it may be evident that people will only spend their leisure time on activities they like, Hart et al. (2022) argue that this approach has not been sufficiently built into the development of CS projects. In terms of recruitment, it is vital to target potential participants whose interests and motivations match the project goals, since only then they will contribute actively and continuously. Therefore, project organizers need to consider potential participants' interests, circumstances, and demographics, and how they will become aware of the opportunity to participate (West and Pateman, 2016). However, as many scientists have not received training in science communication, many CS projects do not approach the recruitment of volunteers systematically and pay little attention to the required types of messages (cf. Brouwer and Hessels, 2019). Therefore, there is a need for studies on the relevance of appropriate recruitment strategies for the success of CS projects.

In the study presented here, we report on the recruitment of participants for a CS project with about 860 participants. First, we aimed at identifying specific target groups. We then investigated which specific marketing tools of the campaign were particularly effective in recruiting new applicants for the project. We also aimed at understanding the influence of the recruitment campaign on the selection of citizens who applied to participate in the project, their motivation to participate, and their actual contribution to different project tasks. This case study describes the development of the recruitment campaign, taking into account the project goals and design, and the evaluation of the campaign using data from applicants' online application forms as well as page views on the project's web page after certain recruitment measures were implemented. In this way, we were able to base the assessment of our recruitment success on both subjective and objective data.

2 Project and applicants

The study was conducted as part of an interdisciplinary research endeavor aimed at elucidating to what extent CS can be used as a tool for science communication. Different CS projects were evaluated regarding participants' individual learning outcomes, emotions, and attitudes (Greving et al., 2020; 2022; 2023; Bruckermann et al., 2021; 2023). Here we present data from a CS project that monitored terrestrial wild mammals in private gardens (i.e., yards that were only accessible by the owners, tenants, or leaseholders and persons living in the same household) in Berlin, Germany, in a standardized manner to analyze spatial and temporal interactions among wild mammal species. In addition, we examined what habitat features in gardens affected the occurrence of wildlife. The CS project was carried out between fall 2018 and fall 2020 in five rounds with the same procedure and content. Each project round lasted a total of approximately two months. Citizens who were interested in participating in this project applied online. Participants were selected on the basis of a systematic sampling grid that consisted of 287 square cells (2 × 2 km each) covering the whole city of Berlin plus adjoining areas. Citizens accepted to the project received a wildlife camera for data collection on loan. The number of participants was limited to 200 per round, corresponding to the number of cameras at our disposal. Each participant could only participate in one project round. Over the course of the project, 74% of the grid cells were sampled with a camera at least once.

In each round, participants received a wildlife camera as well as information about the installation of the camera and data collection. Apart from these offline activities, participants performed all other activities on an online platform that was exclusively set up for this CS project. During the data collection period of four weeks, participants were asked to upload the images from the wildlife camera onto the platform. In addition, they were provided with extensive background information on wildlife in urban areas. They were then asked to identify the species of animals captured in the

images, both in their own and in images taken by other participants. To ensure data quality, species identification was only considered valid when two participants identified the same species. When assessments differed, the image was forwarded to the project scientists who then identified the species. Furthermore, the platform provided a guided tool for participants to graphically display and statistically analyze both the data from their own gardens and the complete dataset of all participants. They also had the opportunity to discuss their results in a forum. Participants had to collect data with their wildlife cameras and assess images on the platform; reading information and analyzing data were optional. Data collection with the cameras was conducted by the participants only, while the evaluation of the images on the platform was supported by the project scientists. Participants' activities on the online platform were tracked by an open source web analytics application for website traffic tracking (Matomo v3.9.1), and the results were published by Bruckermann et al. (2022). Approximately 300,000 wildlife camera images were uploaded by participants, 40,000 of which documented wild terrestrial animals and 34,000 domestic cats. The most common wild species were foxes, raccoons, hedgehogs, and squirrels. The species interactions of the mesocarnivores red fox, marten, raccoon, and domestic cat were analyzed (Louvrier et al., 2021).

3 Target groups and recruitment campaign

In accordance with common procedures in marketing and science communication (e.g., Hart et al., 2022), we identified the target groups in three steps (e.g., Rüfenacht et al., 2021): i) Defining relevant groups, ii) analyzing their perspectives and interests, and iii) mapping their interests onto the project objectives. We then designed the recruitment campaign accordingly.

i) **Defining relevant target groups:** Based on our project goals, we were looking for adult citizens with a private garden. Furthermore, these citizens needed a computer and internet access, as they performed all steps of the project except data collection online.
ii) **Analyzing perspectives and interests:** We used an approach often applied in marketing and design thinking to analyze the interests of our target groups: Developing personas. Personas are fictional characters (i.e., with certain ages, occupations, and interests) representing different target groups (Chang et al., 2008; Nielsen, 2019). These characters help to understand the target groups' needs, behaviors and interests. One key interest we identified was the opportunity to learn about wildlife. Another possible interest was to interact with scientists and other participants. Finally, citizens could have also been interested in contributing to science and analyzing data.
iii) **Mapping interests to project objectives:** Following the analysis of citizens' interests, we linked these interests to the project goals which were: a) Collecting high-quality data about terrestrial mammals, and b) providing citizens with the opportunity to learn about the content and processes of scientific research. Therefore, we needed a large number of volunteering citizens who were willing to engage in all steps of the project.

3.1 Conducting the recruitment campaign

Based on the first three steps, we identified three options for the recruitment campaign: a) A message that appealed to a broad audience for maximum attention, b) a message that addressed a scientifically interested audience, or c) two different messages for these two target groups. All three options had advantages and disadvantages. Since the success of the project hinged on attracting a large number of participants—i) in order to cover large parts of the city area to obtain representative data on urban wildlife, and ii) for our study on the suitability of CS as a tool for science communication—we based our decision on the argument that we needed maximum attention for our campaign. Thus, we chose the message for the broad audience (see Figure 1).

We used this message in a broad range of common marketing formats. These were as follows:

- **Press releases:** At the start of the application period for each project round, we issued a press release with information about the research project and participation. The press release was distributed by the institute conducting the study in Berlin, using distribution services such as dpa (German press agency), idw (information service science), AlphaGalileo, and EurekAlert. It was additionally posted on the institute's website.
- **Project newsletter:** An e-mail newsletter was sent to interested people who had registered for it on the project website. The newsletter contained news from the project and information about the next project rounds and the application process.
- **Interviews and features on radio and television**: Especially in the first project rounds, the press releases were taken up by local media.
- **Posters in transit places:** At the start of the application period for project rounds 1, 3, and 4, we put up posters with two designs (see Figure 1) in train, tram, and bus stations.
- **Flyers and postcards:** We distributed flyers and postcards at public events visited by citizens interested in science (e.g., so-called "Long Night of the Sciences" in Berlin) and to private homes.
- **Newspaper articles:** Following press releases, the project was subject of a number of newspaper articles.
- **Advertisement in a local weekly newspaper:** At the start of the application period of rounds 3–5, we placed advertisements in local newspapers.
- **Announcements on websites:** On specific websites relevant to our target groups, like gardeners, we announced the start of each round of our project.

We did not run a social media campaign (cf. Crall et al., 2017; Brouwer and Hessels, 2019) because our target group of garden owners was likely to be older than, for example, participants in app-based crowdsourcing projects, and therefore less social media savvy.

In most marketing formats given above and depending on the scope of the format, detailed information on the requested time

FIGURE 1
Posters used in the recruitment campaign (Copyright: IZW). Both designs were based on the appeal of discovering wildlife in one's garden. (Text on the poster translated into English: Gotcha! Discover the secret life of your animal neighbors with a wildlife camera. We are looking for curious citizens with gardens in Berlin for a two-month research project. For more information please visit: project's web platform).

commitment for participants were given, for example, in the press releases and project newsletter, on the flyers, in interviews, and in newspaper articles. Additionally, all formats contained the reference and link to the project platform, where detailed information regarding the terms of participation was given. For instance, the level of time commitment was communicated to interested citizens using the statement: "If you are willing to invest about five hours per week for two months for your research activity." Moreover, it was openly communicated during the recruitment process that—corresponding to the number of cameras at our disposal—200 participants could be included in each round, and that we aimed to distribute the cameras as evenly as possible across the city area. Rejected applicants were told that they could apply again in one of the next rounds.

3.2 Effectiveness of the campaign and marketing formats

Recruitment was very successful in terms of the number of applications, as we received more applications for each round than we could allocate places for participants (max. 200 per round). In total, N = 2,071 persons (n_1 = 595, n_2 = 249, n_3 = 300, n_4 = 685, n_5 = 242) applied for the project. The age of the applicants ranged from 19 to 89 years (mean 54.2 years, data from 2,059 applicants, invalid information from 12 applications was excluded). The large number of applicants in the first round resulted from the facts that the project was new, media interest was high, and we used all available marketing formats. The high number of applicants in round 4 may be due to the fact that this round was intended to be the last round and advertised as the last chance to participate. Only after that round, we decided to run round 5 to gather additional data. In round 5, we mainly contacted former applicants who had not been accepted in previous rounds and ran a very reduced recruitment campaign. Participants were selected primarily on the basis of the geographical distribution across the city.

To find out which formats were particularly effective in the recruitment strategy, applicants of rounds 3 to 5 were asked in the application form how they had heard of the project. Each applicant could give more than one answer (multiple choice question). Figure 2 shows the responses of applicants in rounds 3 and 4. Answers from round 5 applicants are not included because in that round we did not use all of the formats available from the recruitment campaign.

The results show that newspaper articles and posters in public spaces were the most effective marketing formats. Personal recommendations from family and friends also prompted a number of people to apply, which shows their importance as multipliers. On the other hand, TV and radio features and the distribution of flyers and postcards did not reach as many people as anticipated (e.g., radio feature, 4.4% in round 3, 6.6% in round 4). This may be related to the fact that TV and radio features are very limited in time (normally a few minutes) and also depend on factors such as the popularity and ratings of the radio or TV station, the day and time of broadcasting, and whether the feature is also posted online after broadcasting. The internet was given as a source by a relatively low percentage of mentions (8.5% in round 3, 11.8% in round 4), compared to newspaper articles and public posters. This may be explained by the fact that we announced the project on some relevant internet portals but not on social media. However, in some cases newspaper articles were also published online.

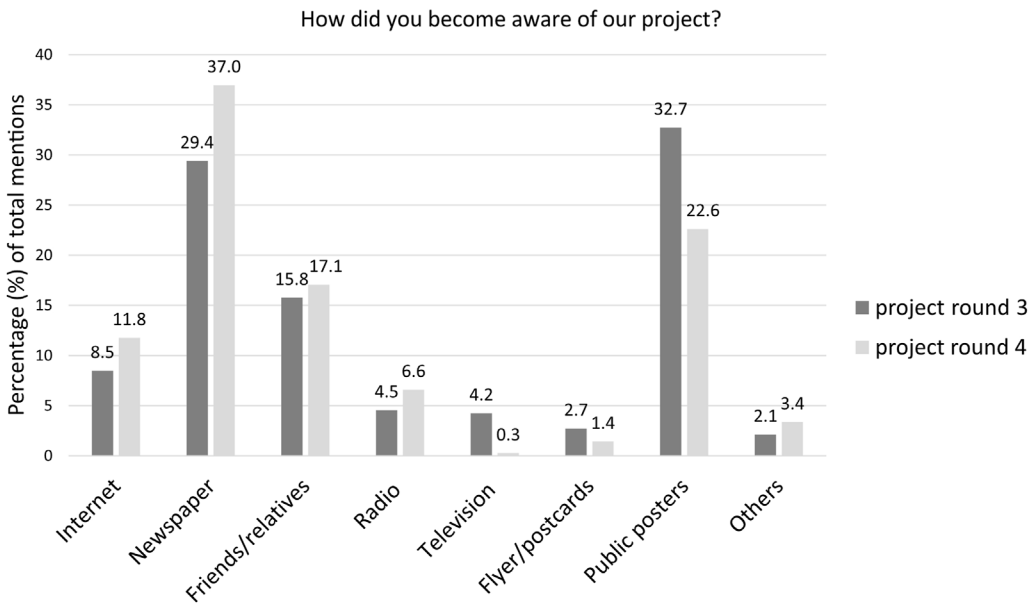

FIGURE 2
Information provided by applicants (n = 300 in round 3, n = 685 in round 4) on how they become aware of our project (via internet, newspapers, friends/relatives, radio, television, flyer/postcards, public posters, or other formats). Mentions per category are given as a percentage of the total number of mentions (n = 330 in round 3, n = 774 in round 4).

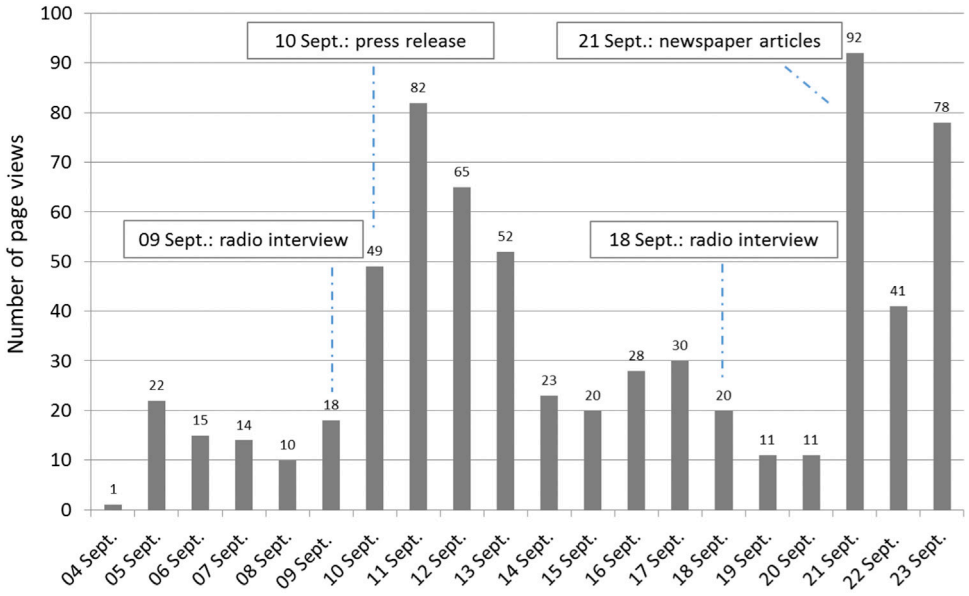

FIGURE 3
Number of page views per day of the public project's online platform over 20 days during the application period for round 1 (September 10th to 23rd, 2018). The dates of the use of recruitment formats with high reach are indicated.

It should be noted that although the data in Figure 2 are presented per round, this does not reflect at what time of the project course applicants became aware of the project. It is also possible that applicants had already learned about the project through one format or various ones prior to the particular round for which they applied.

We tracked website traffic to the public project's online platform. As anticipated, page views increased (same day or next day) following the use of recruitment formats with high reach, such as press releases, newspaper articles, or radio or television reports (see Figure 3). For example, the number of

TABLE 1 Counts (in total numbers and percent) of content words and their synonyms given by applicants (n = 1,775) in answer to the question "Why are you interested in putting up a wildlife camera in your garden?"

Category	Content word	Synonyms (exampl.)	Count numbers	Percentage (%)
Wildlife	Wildlife	Animal(s) incl. wild animal(s)	1082	61.0
Place	Garden	House, property	913	51.4
Epistemology	Science	Scientific, knowledge	343	19.3
	Contribution	Contribute, contributing	36	2.0
	Analysis	Analyze, analyses	13	0.7
	Research		82	4.6

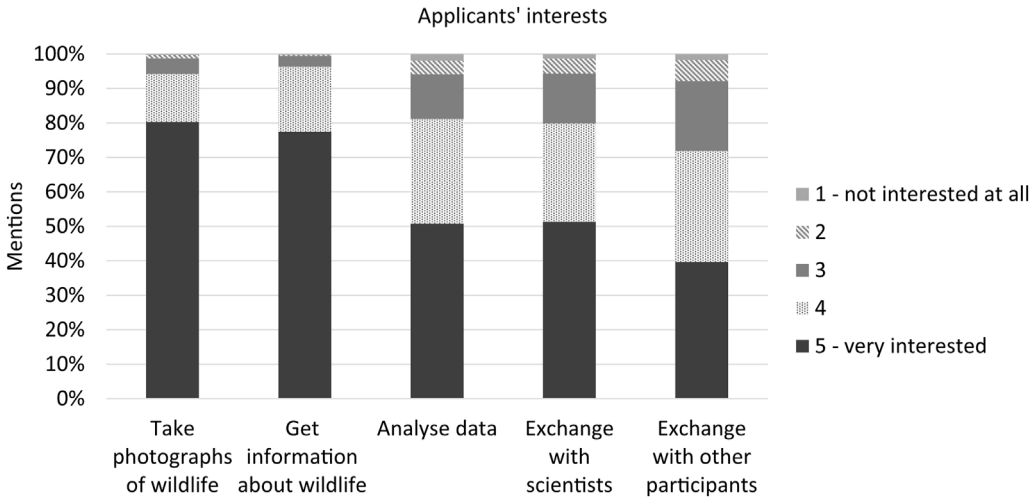

FIGURE 4
Applicants' interests to participate in the project across all five rounds on a 5-point scale ranging from 1 (not interested at all) to 5 (very interested).

page views was more than eight times higher on the day when a popular local newspaper published an article (92 page views on September 21st) than on the previous day (11 page views on September 20th).

3.3 Applicants' interests in participating

In order to investigate why applicants applied for the project, we asked them in the application form how much they were interested in five different reasons to participate (i.e., to take photographs of wildlife, get information about wildlife, analyze data, interact with scientists, interact with other participants) on a 5-point scale ranging from 1 (not interested at all) to 5 (very interested). Moreover, we asked them in a question with an open answer format for the reasons why they wanted to install a wildlife camera in their garden. All statements were screened by a human rater for specific content words and their synonyms (see Table 1). Then we counted how many applicants mentioned these words.

As shown in Figure 4, the results indicated that applicants were especially interested in taking photographs of wildlife (80.3% very interested and 13.9% interested) and getting information about wildlife (77.4% very interested and 18.9% interested). Applicants were less interested in analyzing data (50.8% very interested and 30.3% interested), interacting with scientists (51.3% very interested and 28.5% interested), and interacting with other participants (39.7% very interested and 32.2% interested). These results were consistent with the statements from the open question (Table 1). Here, most applicants specifically mentioned words related to wildlife or related to their house and surroundings. In contrast, words related to epistemology and involvement in the research process were mentioned much less frequently.

4 Discussion

Recruitment was very successful in terms of the number of applications we received, with the broad range of marketing formats and the visually appealing messages likely being key to this success. We conclude that different communication formats should be used in a targeted manner to achieve recruitment goals, taking into account the specifics of different formats such as target groups, reach, duration, and costs, as well as available financial and human resources. Mass media such as newspaper ads and posters in the

public sphere were the most prominent sources for recruitment, as previous research also showed (e.g., West and Pateman, 2016). In addition to these formats, recruitment in the private sphere through friends and relatives was also successful, which extends the findings of previous research (Crall et al., 2017). Linking the project's research to people's own gardens probably facilitated recruitment, because an affective connection to participants' local environments (Dunkley, 2017) and relevance of CS to everyday life (Hart et al., 2022) have been shown to be drivers of participation. In addition, people knew that opportunities to participate were limited, and that they only had to commit for a defined amount of time (two months).

Participants' motivations clearly reflected the focus on wildlife and the desire to learn more about the animals in their own garden, while contributing to the research process was not a significant driver to participate. We are aware that the phrasing of the questions is important for assessing motivations. The link to contributing to science may have been less obvious with the question of "Why are you interested in putting up a wildlife camera in your garden?" than it may have been with a broader question such as "Why do you want to participate in the project?". However, the results regarding the answers to this question matched those regarding the applicants' interest in contributing to different steps of the research process. Furthermore, some applicants may have given socially desirable answers in order to be accepted into the project: They may have expressed their interest in analyzing data and the scientific process because we explicitly stated on the website that we expected volunteers to contribute to more than data collection. In summary, we conclude that participants were more interested in monitoring wildlife in their gardens than in contributing to science or learning about the scientific process.

Strasser et al. (2019) have stressed that the term "citizen science" itself, as well as science communication within and about CS projects influence the public perception and the expectations associated with such projects. In their communication, projects could, for example, highlight the link to the participants' everyday life, which appears to be a strong motivator in our as well as in other studies (Wagenknecht et al., 2021). In contrast, we did not find that contributing to science and learning about science were powerful recruitment messages or motivators, which is counter to a number of other studies (Raddick et al., 2010; Curtis, 2015; Land-Zandstra et al., 2015; Alender, 2016; Land-Zandstra et al., 2016; Lee et al., 2018; Lopez, 2021; Etter et al., 2023). Community building through science communication among participants as well as between participants and scientists has also been described as a success factor for CS projects (Golumbic et al., 2020). However, interaction with others in the community was not a main motivator for participants in the current study—in contrast to the online project *FoldIt* (Curtis, 2015), for example, and projects on environmental issues involving data collection in the field (Bradford and Israel, 2004; Wright et al., 2015). Of course, which factors are the main motivators for participants to contribute depends on the subject of the project, the tasks and involvement of the participants, and the personal relevance and possibilities for citizens. In our project, the link to one's own garden seems to have been the decisive factor in determining participants' motivations.

How these motivations influenced the project outcomes is elucidated by previous research in this project that investigated participants' behavioral activities on the online platform (Bruckermann et al., 2022). This study found that participants were more active and lurked less (i.e., were less passive) during the data collection phase of the project (i.e., when participants took photographs with the wildlife cameras and identified the species on the photographs). In contrast, during the data analysis phase (i.e., when participants had the opportunity to analyze their own data and the data of all participants) they were less active and lurked more. This finding corresponds to the participants' high and foremost interest in wildlife and their not so pronounced interest in data analysis or interaction with scientists. In addition, a social loafing effect, that is, a tendency to exert less effort in group activities compared to when one is acting alone (Latané et al., 1979), could also have affected participant behavior. Kaufman et al. (2016) found that in a crowdsourcing game, participants contributed less when a high number of fellow contributors was highlighted in project communication. In our case, participants may have been motivated to record the wildlife in their own garden, but felt that data analysis and discussion were covered by the professional scientists and other participants.

Applicants' motivations also show that the recruitment campaign resulted in a selection of participants who wanted to record wildlife in their gardens, and in terms of the contributions participants also acted accordingly. Their behavior corresponds to another study from our project which found no increase in participants' scientific reasoning skills in the course of the project (Bruckermann et al., 2023). This finding is in concordance with the fact that participants engaged mostly during data collection and were less active during the other steps in the research process. The motivation of participants we selected through our recruitment campaign thus may have had a significant impact on the outcomes of the project. These results emphasize that it is vital for CS projects to tailor their communication to the specific needs, interests, and motivations of the people involved. Wagenknecht et al. (2021) distinguished two objectives of communication in CS projects: 1) Communication to ensure that a project succeeds, and 2) enhancing citizens' understanding and awareness of a scientific issue. Based on the current case study, we would argue that these two objectives may confluence in cases where the success of the project depends on participants' involvement in several phases of the research process, since such involvement in turn requires an adequate understanding of this process and the scientific background.

In summary, our case study showed that science communication is highly relevant in the context of CS. On the one hand, knowledge and methods from science communication were indispensable for the recruitment of and communication with the participants: We analyzed target groups, used different marketing formats, and formulated target- and audience-oriented messages during the recruitment process as well as during the course of the project. On the other hand, our CS project was also intended as a tool for science communication in order to give participants information about urban wildlife as well as insights into and an understanding of different steps of the scientific research process. Such synergies of CS

and science communication should be explicitly taken into account and further developed in the future.

5 Conclusion

In this case study, we highlighted the importance of purposely designing recruitment messages and strategies for CS projects. These strategies can influence the selection of participants, which in turn is an important factor for volunteer engagement and sustained contribution to the project. Our results demonstrated that, before the start of the project, researchers should deliberately consider i) which candidates are particularly suitable with regard to the project goals, ii) what are those candidates' interests and motivations, and iii) which messages and channels are needed to reach the preferred target groups. The data of this research further suggested that if CS project organizers aim at reaching a large number of potential participants, they need to use a broad range of communication formats and use them continually as long as participants need to be recruited. Finally, we could illustrate that assessing participants interests can provide helpful information that may be already relevant when starting the project. All in all, this case study presents valid and important results on the necessity of well-thought recruitment strategies that ultimately contribute to the success of CS projects.

Data availability statement

The raw data supporting the conclusion of this article will be made available by the authors, without undue reservation.

Author contributions

AS: Formal Analysis, Investigation, Methodology, Project administration, Visualization, Writing–original draft. HG: Methodology, Writing–original draft, Writing–review and editing. TB: Methodology, Writing–review and editing. JK: Conceptualization, Funding acquisition, Writing–review and editing. UH: Conceptualization, Funding acquisition, Writing–review and editing. MB: Conceptualization, Funding acquisition, Methodology, Supervision, Writing–original draft, Writing–review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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